CPC     COOPERATIVE PATENT CLASSIFICATION

B     PERFORMING OPERATIONS; TRANSPORTING
(NOTES omitted)

SHAPING

B23     MACHINE TOOLS; METAL-WORKING NOT OTHERWISE PROVIDED FOR
(NOTES omitted)

B23K     SOLDERING OR UNSOLDERING; WELDING; CLADDING OR PLATING BY
SOLDERING OR WELDING; CUTTING BY APPLYING HEAT LOCALLY, e.g.
FLAME CUTTING; WORKING BY LASER BEAM (making metal-coated products by
extruding metal B21C 23/22; building up linings or coverings by casting B22D 19/08; casting
by dipping B22D 23/04; manufacture of composite layers by sintering metal powder B22F 7/00;
arrangements on machine tools for copying or controlling B23Q; covering metals or covering
materials with metals, not otherwise provided for C23C; burners F23D)

NOTES
1. This subclass covers also electric circuits specially adapted for the purposes covered by the title of the subclass.
2. In this subclass, the following term is used with the meaning indicated:
   • “soldering” means uniting metals using solder and applying heat without melting either of the parts to be united

WARNINGS
1. The following IPC groups are not in the CPC scheme. The subject matter for these IPC groups is classified in the following
CPC groups:
   B23K 35/04 - B23K 35/20 covered by B23K 35/0205 - B23K 35/294
   B23K 35/363 covered by B23K 35/3601 - B23K 35/3618
2. In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the
scheme.

Soldering, e.g. brazing, or unsoldering (essentially requiring the use
of welding machines or welding equipment, see the relevant groups
for the welding machines or welding equipment)

1/00     Soldering, e.g. brazing, or unsoldering (B23K 3/00 takes precedence; characterised only by the use
of special materials or media B23K 35/00; dip or wave soldering in the manufacture of printed circuits
H05K 3/34)
   1/0002 . {Soldering by means of dipping in a fused salt bath}
   1/0004 . {Resistance soldering}
   1/0006 . {Exothermic brazing}
   1/0008 . {specially adapted for particular articles or work}
   1/001 . . {Sealing small holes in metal containers, e.g. tins}
   1/0012 . . {Brazing heat exchangers}
   1/0014 . . {Brazing of honeycomb sandwich structures}
   1/0016 . . {Brazing of electronic components}
   1/0018 . . {Brazing of turbine parts}
   1/002 . . {Soldering by means of induction heating}
   1/005 . . {Soldering by means of radiant energy}
   1/0053 . . . {soldering by means of I.R.}
   1/0056 . . . {soldering by means of beams, e.g. lasers, E.B.}
   1/008 . . {Soldering within a furnace (B23K 1/012 takes precedence)}
   1/012 . . {Soldering with the use of hot gas}
   1/015 . . {Vapour-condensation soldering}
   1/018 . . Unsoldering; Removal of melted solder or other residues
   1/06 . . making use of vibrations, e.g. supersonic vibrations
   1/08 . . Soldering by means of dipping in molten solder
   1/085 . . . {Wave soldering}
   1/14 . . specially adapted for soldering seams (making tubes involving operations other than soldering B21C)
   1/16 . . . longitudinal seams, e.g. of shells
   1/18 . . . circumferential seams, e.g. of shells
   1/19 . . . taking account of the properties of the materials to be soldered
   1/20 . . . Preliminary treatment of work or areas to be soldered, e.g. in respect of a galvanic coating
   1/203 . . . {Fluxing, i.e. applying flux onto surfaces}
   1/206 . . . {Cleaning}

3/00     Tools, devices, or special appurtenances for
soldering, e.g. brazing, or unsoldering, not
specially adapted for particular methods (materials
used for soldering B23K 35/00)
   3/02 . . Soldering irons; Bits
   3/021 . . . {Flame-heated soldering irons}
   3/022 . . . . {using a gaseous fuel}
   3/023 . . . . {using a liquid fuel}
   3/024 . . . . {using a solid fuel}
Soldering, e.g. brazing, or unsoldering

3/025 . . . {Bits or tips}
3/026 . . . {Removable soldering bits}
3/027 . . . {Holders for soldering irons}
3/028 . . . {Devices for cleaning soldering iron tips (B23K 3/027 takes precedence)}
3/029 . . . {Solder or residue removing devices}
3/03 . . . . electrically heated
3/0307 . . . . [with current flow through the workpiece]
3/0315 . . . . [Quick-heating soldering irons having the tip-material forming part of the electric circuit (B23K 3/0323 takes precedence)]
3/0323 . . . . [Battery-powered soldering irons]
3/033 . . . . [comprising means for controlling or selecting the temperature or power]
3/0338 . . . . [Constructional features of electric soldering irons]
3/0346 . . . . {Handles}
3/0353 . . . . . {Heating elements or heating element housings}
3/0361 . . . . . {Couplings between the handle and the heating element housing}
3/0369 . . . . . {Couplings between the heating element housing and the bit or tip}
3/0376 . . . . . [comprising carbon heating elements or electrodes (B23K 3/0384 and B23K 3/0392 take precedence)]
3/0384 . . . . . {the heat being generated by an arc}
3/0392 . . . . . {the heat being generated by contact resistance}
3/04 . . . . . Heating appliances (soldering lamps or blowpipes B23D; electric heating in general H05B)
3/043 . . . . . {Flame-heated appliances}
3/047 . . . . . electric
3/0471 . . . . . {using resistance rod or bar, e.g. carbon silica}
3/0473 . . . . . {using Joule effect at the place of contact between a rod and the soldering tip}
3/0475 . . . . . {using induction effects, e.g. Kelvin or skin effects}
3/0476 . . . . . {Soldering pliers}
3/0478 . . . . . {comprising means for controlling or selecting the temperature or power}
3/053 . . . . . using resistance wires
3/06 . . . . . Solder feeding devices; Solder melting pans
3/0607 . . . . . {Solder feeding devices}
3/0615 . . . . . {forming part of a soldering iron}
3/0623 . . . . . {for shaped solder piece feeding, e.g. preforms, bumps, balls, pellets, droplets}
3/063 . . . . . {for wire feeding}
3/0638 . . . . . {for viscous material feeding, e.g. solder paste feeding (B23K 3/0623 takes precedence)}
3/0646 . . . . . {Solder baths}
3/0653 . . . . . {with wave generating means, e.g. nozzles, jets, fountains}
3/0661 . . . . . {Oscillating baths}
3/0669 . . . . . {with dipping means}
3/0676 . . . . . . {Conveyors therefor}
3/0684 . . . . . . {with means for oscillating the workpiece}
3/0692 . . . . . . {with intermediary means for bringing solder on workpiece, e.g. rollers}
3/08 . . . . . Auxiliary devices therefor (cleaning pipes or tubes or systems of pipes or tubes, e.g. before soldering, B08B 9/02)
3/082 . . . . . {Flux dispensers; Apparatus for applying flux}
3/085 . . . . . {Cooling, heat sink or heat shielding means}
3/087 . . . . . {Soldering or brazing jigs, fixtures or clamping means}

Flame welding or cutting

5/00 Gas flame welding
5/003 . . . . . {the welding zone being shielded against the influence of the surrounding atmosphere (selection of media B23K 35/38)}
5/006 . . . . . {specially adapted for particular articles or work}
5/02 . . . . . Seam welding (making tubes involving operations other than welding B21C)
5/023 . . . . . {of horizontal seams in assembling vertical plates a welding unit being adapted to travel along the upper horizontal edge of the plates}
5/026 . . . . . {of non-horizontal seams in assembling non-horizontal plates}
5/04 . . . . . using additional profiled strips or the like of welding metal along seam edges
5/06 . . . . . Welding longitudinal seams
5/08 . . . . . Welding circumferential seams
5/083 . . . . . . {Welding three-dimensional seams}
5/086 . . . . . . . {helicoidal seams}
5/10 . . . . . Welding workpieces essentially comprising layers of different metals, e.g. plated workpieces
5/12 . . . . . taking account of the properties of the material to be welded
5/14 . . . . . of non-ferrous metals (B23K 5/16 takes precedence)
5/16 . . . . . of different metals
5/18 . . . . . for purposes other than joining parts, e.g. built-up welding
5/20 . . . . . making use of vibrations, e.g. supersonic vibrations
5/213 . . . . . {Preliminary treatment}
5/22 . . . . . Auxiliary equipment, e.g. backings, guides
5/24 . . . . . Arrangements for supporting torches (not restricted to flame welding B23K 37/02)

7/00 Cutting, scarfing, or desurfacing by applying flames (thermal deburring B23D 79/005)
7/001 . . . . . {for profiling plate edges or for cutting grooves}
7/002 . . . . . {Machines, apparatus, or equipment for cutting plane workpieces, e.g. plates}
7/003 . . . . . {Machines, apparatus, or equipment for cutting long articles, e.g. cast stands, plates, in parts of predetermined length}
7/004 . . . . . {Steam tracking}
7/005 . . . . . {Machines, apparatus, or equipment specially adapted for cutting curved workpieces, e.g. tubes}
7/006 . . . . . {for tubes}
7/007 . . . . . . {for obtaining tube intersection profiles}
7/008 . . . . . {Preliminary treatment}
7/009 . . . . . {Machines, apparatus, or equipment specially designed for scarfing or desurfacing
7/008 . . . . . by applying additional compounds or means favouring the cutting, scarfing, or desurfacing procedure
7/10 . . . . . Auxiliary devices, e.g. for guiding or supporting the torch (guiding means applicable to other metal-working machines B23Q)
7/102 . . . . . {for controlling the spacial relationship between the workpieces and the gas torch}
7/105 . . . . . {specially adapted for particular geometric forms}
Electric welding or cutting

9/00 Arc welding or cutting (electro-slag welding B23K 2500; welding transformers H01F; welding generators H02K)

9/0008 . . . [Welding without shielding means against the influence of the surrounding atmosphere]
9/0017 . . . [using more than one electrode]
9/0026 . . . [specially adapted for particular articles or work]
9/0035 . . . [of thin articles]
9/0043 . . . [Locally welding a thin plate to a thick piece (spot arc welding B23K 9/007)]
9/0052 . . . [Welding of pipe panels]
9/0061 . . . [Underwater arc welding]
9/007 . . . Spot arc welding
9/013 . . . Arc cutting, gouging, scarfing or desurfacing
9/0135 . . . [Arc saw cutting]
9/02 . . . Seam welding; Backing means; Inserts
9/0203 . . . [Inserts]
9/0206 . . . [of horizontal seams in assembling vertical plates, a welding unit being adapted to travel along the upper horizontal edge of the plates]
9/0209 . . . [of non-horizontal seams in assembling non-horizontal plates]
9/0213 . . . [Narrow gap welding]
9/0216 . . . [Seam profiling, e.g. weaving, multilayer]
9/022 . . . Welding by making use of electrode vibrations
9/025 . . . [for rectilinear seams]
9/0253 . . . [for the longitudinal seam of tubes]
9/0256 . . . [for welding ribs on plates]
9/028 . . . [for curved planar seams]
9/0282 . . . [for welding tube sections]
9/0284 . . . [with an electrode working inside the tube]
9/0286 . . . [with an electrode moving around the fixed tube during the welding operation]
9/0288 . . . [for welding of tubes to tube plates]
9/032 . . . [for three-dimensional seams]
9/0325 . . . [helicoidal seams]
9/035 . . . [with backing means disposed under the seam]
9/0352 . . . [the backing means being movable during the welding operation]
9/0354 . . . [the backing means being expandable]
9/0356 . . . [the backing means being a tape or strip]
9/0358 . . . [the backing means being a ring or sleeve]
9/038 . . . using moulding means (not restricted to arc welding B23K 37/06)
9/04 . . . Welding for other purposes than joining, e.g. built-up welding
9/042 . . . [Built-up welding on planar surfaces]
9/044 . . . [Built-up welding on three-dimensional surfaces]
9/046 . . . [on surfaces of revolution]
9/048 . . . [on cylindrical surfaces]
9/06 . . . Arrangements or circuits for starting the arc, e.g. by generating ignition voltage, or for stabilising the arc
9/067 . . . Starting the arc
9/0671 . . . [by means of brief contacts between the electrodes]
9/0672 . . . [without direct contact between electrodes]
9/0673 . . . [Ionisation of the arc gap by means of a tension with a step front (pulses or high frequency tensions)]
9/0675 . . . [Ionisation of the arc gap by means of radiation or particle bombardment]
9/0676 . . . [Ionisation of the arc gap by means of heating]
9/0677 . . . [Ionisation of the arc gap by means of a contact piece disposed between the electrodes]
9/0678 . . . [Ionisation of the arc gap by means of an auxiliary arc]
9/073 . . . Stabilising the arc
9/0731 . . . [Stabilising of the arc tension]
9/0732 . . . [Stabilising of the arc current]
9/0734 . . . [Stabilising of the arc power]
9/0735 . . . [Stabilising of the arc length]
9/0737 . . . [Stabilising of the arc position]
9/0738 . . . [Stabilising of the arc by automatic re-ignition means]
9/08 . . . Arrangements or circuits for magnetic control of the arc [stabilising of the arc position by magnetic means B23K 9/0737]]
9/09 . . . Arrangements or circuits for arc welding with pulsed current or voltage
9/091 . . . [characterised by the circuits]
9/092 . . . [characterised by the shape of the pulses produced]
9/093 . . . [the frequency of the pulses produced being modulatable]
9/095 . . . Monitoring or automatic control of welding parameters
9/0953 . . . [using computing means]
9/0956 . . . [using sensing means, e.g. optical]
9/10 . . . Other electric circuits therefor; Protective circuits; Remote controls
9/1006 . . . [Power supply]
9/1012 . . . [characterised by parts of the process]
9/1018 . . . [Improvements of the cos (phi) of arc welding installations]
9/1025 . . . [Means for suppressing or reducing DC components in AC arc welding installations]
9/1031 . . . [Reduction of the arc voltage beneath the arc striking value, e.g. to zero voltage, during non-welding periods]
9/1037 . . . [Means preventing crater forming at the extremity of the seam]
9/1043 . . . [characterised by the electric circuit (B23K 9/1012 takes precedence)]
9/105 . . . [by using discharge tubes or mechanical contactors (B23K 9/1068 takes precedence)]
9/1056 . . . [by using digital means (B23K 9/1068 takes precedence)]
9/1062 . . . [with computing means]
9/1068 . . . [Electric circuits for the supply of power to two or more arcs from a single source]
9/1075 . . . [Parallel power supply, i.e. multiple power supplies or multiple inverters supplying a single arc or welding current]
9/1081 . . . [Arc welding by means of accumulated energy]
9/1087 . . . [Arc welding using remote control]
9/1093 . . . [Consumable electrode or filler wire preheat circuits]
9/12 . . . Automatic feeding or moving of electrodes or work for spot or seam welding or cutting
9/121 . . . [Devices for the automatic supply of at least two electrodes one after the other]
Electric welding or cutting

B23K

9/122 . . . [Devices for guiding electrodes, e.g. guide tubes]
9/123 . . . [Serving also as contacting devices supplying welding current to an electrode]
9/124 . . . [Circuits or methods for feeding welding wire]
9/125 . . . [Feeding of electrodes (for stabilising arc B23K 9/073)]
9/126 . . . [Controlling the spatial relationship between the work and the gas torch (between wire tip and piece B23K 9/073)]
9/127 . . . Means for tracking lines during arc welding or cutting (copying in general B23Q 35/00)
9/1272 . . . [Geometry oriented, e.g. beam optical trading]
9/1274 . . . [Using non-contact, optical means, e.g. laser means]
9/1276 . . . [Using non-contact, electric or magnetic means, e.g. inductive means]
9/1278 . . . [Using mechanical means]
9/133 . . . Means for feeding electrodes, e.g. drums, rolls, motors
9/1333 . . . [Dereeling means]
9/1336 . . . [Driving means]
9/14 . . . making use of insulated electrodes
9/142 . . . [Drag welding, the arc length being determined by an insulated layer between the welding electrode and the welding spot or seam]
9/145 . . . [the insulated welding electrode being laid along the seam]
9/147 . . . [the insulated welding electrode resting with one extremity on the workpiece]
9/16 . . . making use of shielding gas (selection of media B23K 35/38)]
9/162 . . . [making use of a stationary fluid]
9/164 . . . [making use of a moving fluid]
9/167 . . . [and of a non-consumable electrode]
9/1675 . . . [making use of several electrodes]
9/173 . . . [and of a consumable electrode]
9/1735 . . . [making use of several electrodes]
9/18 . . . Submerged-arc welding
9/182 . . . [making use of a non-consumable electrode]
9/184 . . . [making use of several electrodes]
9/186 . . . [making use of a consumable electrodes]
9/188 . . . [making use of several electrodes]
9/20 . . . Stud welding
9/201 . . . [of the extremity of a small piece on a great or large basis]
9/202 . . . [by means of portable equipment, e.g. stud welding gun]
9/203 . . . [of cooling fins]
9/205 . . . [Means for determining, controlling or regulating the arc interval]
9/206 . . . [with automatic stud supply]
9/207 . . . [Features related to studs (welding studs per se B23K 35/0288)]
9/208 . . . [Ferrules, e.g. for confining molten material]
9/22 . . . Percussion welding
9/23 . . . taking account of the properties of the materials to be welded
9/232 . . . [of different metals]
9/235 . . . Preliminary treatment
9/24 . . . Features related to electrodes (form or composition of electrodes B23K 35/00)
9/26 . . . Accessories for electrodes, e.g. ignition tips
9/28 . . . Supporting devices for electrodes (not restricted to arc welding or cutting B23K 37/02)
9/282 . . . [Electrode holders not supplying shielding means to the electrode]
9/285 . . . [Cooled electrode holders]
9/287 . . . [Supporting devices for electrode holders (not restricted to arc welding B23K 37/02)]
9/29 . . . Supporting devices adapted for making use of shielding means
9/291 . . . [the shielding means being a gas]
9/293 . . . [using consumable electrode-rod]
9/295 . . . [using consumable electrode-wire]
9/296 . . . [using non-consumable electrodes]
9/298 . . . [the shielding means being a powder]
9/30 . . . Vibrating holders for electrodes (B23K 9/022 takes precedence)
9/32 . . . Accessories (earthing connections H01R)
9/321 . . . [Protecting means (protecting means in general F16P 1/06)]
9/322 . . . [Head protecting means (masks, shields or hoods for weldersp A61F 9/06)]
9/323 . . . [Combined coupling means, e.g. gas, electricity, water or the like (electrical only H01R)]
9/324 . . . [Devices for supplying or evacuating a shielding or a welding powder, e.g. a magnetic powder]
9/325 . . . [Devices for supplying or evacuating shielding gas]
9/326 . . . [Purge gas rings, i.e. devices for supplying or evacuating shielding gas inside of hollow or tubular articles, e.g. pipes, vessels]
9/327 . . . [Means for transporting supplies (carriages in general B23K 37/02)]
9/328 . . . [Cleaning of weld torches, i.e. removing weld-spatter; Preventing weld-spatter, e.g. applying anti-adhesives]

10/00 Welding or cutting by means of a plasma
10/003 . . . [Scarifying, desurfacing or deburring (by applying flames B23K 7/06)]
10/006 . . . [Control circuits therefor (circuits for plasma torches H05H 1/36)]
10/02 . . . Plasma welding
10/022 . . . [Spot welding]
10/025 . . . [by making use of electrode vibrations]
10/027 . . . [Welding for purposes other than joining, e.g. build-up welding]

11/00 Resistance welding; Severing by resistance heating
11/006 . . . [the welding zone being shielded against the influence of the surrounding atmosphere (selection of media B23K 35/38)]
11/0013 . . . [welding for reasons other than joining, e.g. build-up welding]
11/002 . . . [specially adapted for particular articles or work]
11/0026 . . . [Welding of thin articles]
11/0033 . . . [Welding locally a thin plate to a large piece]
11/004 . . . [Welding of a small piece to a great or broad piece]
11/0046 . . . [the extremity of a small piece being welded to a base, e.g. cooling studs or fins to tubes or plates]
11/0053 . . . [Stud welding, i.e. resistive (with an arc B23K 9/20)]
11/006 . . . [Welding a tip to a base, e.g. pen point nibs]
Electric welding or cutting

- Welding by high-frequency current heating
  - 13/00
    - 13/01
      - by induction heating
    - 13/015
      - Butt welding
    - 13/02
      - Seam welding
    - 13/025
      - (for tubes)
    - 13/04
      - by conduction heating (B23K 13/02 takes precedence)
    - 13/043
      - (Seam welding)
    - 13/046
      - (for tubes)
    - 13/06
      - characterised by the shielding of the welding zone against influence of the surrounding atmosphere (selection of media B23K 35/38)
    - 13/08
      - Electric supply or control circuits therefor

- Welding or cutting
  - Electric welding or cutting
  - [characterised by the electric circuits used therewith]
  - Welding of coated materials
  - Galvanizing of metallic materials
  - Welding of coated materials
  - Galvanizing of metallic materials
  - Electric welding or cutting
  - [characterised by the electric circuits used therewith]
  - Welding of coated materials
  - Galvanizing of metallic materials
  - Welding of coated materials
  - Galvanizing of metallic materials

- Welding by high-frequency current heating
  - 13/00
    - by induction heating
    - Butt welding
    - Seam welding
    - (for tubes)
    - by conduction heating (B23K 13/02 takes precedence)
    - (Seam welding)
    - (for tubes)
    - characterised by the shielding of the welding zone against influence of the surrounding atmosphere (selection of media B23K 35/38)
    - Electric supply or control circuits therefor
Other welding or cutting: Working by laser beam

15/00 Electron-beam welding or cutting (electron- or ion-beam tubes B01J 37/00)

15/0006 . . . [specially adapted for particular articles]
15/0013 . . . [Positioning or observing workpieces, e.g. with respect to the impact; Aligning, aiming or focusing electronbeams]
15/002 . . . [Devices involving relative movement between electronbeam and workpiece]
15/0026 . . . [Auxiliary equipment]
15/0033 . . . [Preliminary treatment]
15/004 . . . [Tandem beams or torches, i.e. working simultaneously with several beams or torches]
15/0046 . . . [Welding]
15/0053 . . . [Seam welding]
15/006 . . . . . . [of rectilinear seams]
15/0066 . . . . . . [with backing means disposed under the seams]
15/0073 . . . . . . [with interposition of particular material to facilitate connecting the parts, e.g. using a filler]
15/008 . . . . . . [Spot welding]
15/0086 . . . . . . [welding for purposes other than joining, e.g. built-up welding]
15/0093 . . . . . . [characterised by the properties of the materials to be welded]
15/02 . . . . . . Control circuits therefor
15/04 . . . . . . for welding anular seams
15/06 . . . . . . within a vacuum chamber (B23K 15/04 takes precedence)
15/08 . . . . . . Removing material, e.g. by cutting, by hole drilling
15/085 . . . . . . [Boring]
15/10 . . . . . . Non-vacuum electron beam-welding or cutting

17/00 Use of the energy of nuclear particles in welding or related techniques

20/00 Non-electric welding by applying impact or other pressure, with or without the application of heat, e.g. cladding or plating

20/001 . . . [by extrusion or drawing]
20/002 . . . [specially adapted for particular articles or work (B23K 20/122 takes precedence)]
20/004 . . . . . . [Wire welding]
20/005 . . . . . . [Capillary welding]
20/007 . . . . . . . . . . . . [Ball bonding]
20/008 . . . . . . [pressure combined with radiant energy]
20/02 . . . . . . by means of a press (: Diffusion bonding (B23K 20/001, B23K 20/004 take precedence))
20/021 . . . . . . [Isostatic pressure welding]
20/023 . . . . . . [Thermo-compression bonding]
20/025 . . . . . . [Bonding tips therefor]
20/026 . . . . . . [with diffusion of soldering material]
20/028 . . . . . . . . . . . . [Butt welding]
20/04 . . . . . . by means of a rolling mill
20/06 . . . . . . by means of high energy impulses, e.g. magnetic energy
20/08 . . . . . . Explosive welding
20/085 . . . . . . [for tubes, e.g. plugging]
20/10 . . . . . . making use of vibrations, e.g. ultrasonic welding
20/103 . . . . . . [using a roller]
20/106 . . . . . . [Features related to sonotrodes]
20/12 . . . . . . the heat being generated by friction; Friction welding
20/1205 . . . . . . [using translation movement]
20/121 . . . . . . [Control circuits therefor]
20/1215 . . . . . . [for other purposes than joining, e.g. built-up welding]
20/122 . . . . . . [using a non-consumable tool, e.g. friction stir welding]
20/1225 . . . . . . . [Particular aspects of welding with a non-consumable tool]
20/123 . . . . . . [Controlling or monitoring the welding process]
20/1235 . . . . . . [with temperature control during joining]
20/124 . . . . . . [at the beginning or at the end of a weld]
20/1245 . . . . . . [characterised by the apparatus]
20/125 . . . . . . . . . . . . [Rotary tool drive mechanism]
20/1255 . . . . . . . . . . . . [Tools therefor, e.g. characterised by the shape of the probe]
20/126 . . . . . . . . . . . . [Workpiece support, i.e. backing or clamping]
20/1265 . . . . . . . . . . . . [Non-butt welded joints, e.g. overlap-joints, T-joints or spot welds]
20/127 . . . . . . . . . . . . [friction stir welding involving a mechanical connection (forged connections B21K 25/005; riveted connections B21J 15/027)]
20/1275 . . . . . . . . . . . . [involving metallurgical change]
20/128 . . . . . . . . . . . . [making use of additional material]
20/1285 . . . . . . . . . . . . [Portable friction welding machines]
20/129 . . . . . . . . . . . . [specially adapted for particular articles or workpieces]
20/1295 . . . . . . . . . . . . [Welding studs]
20/14 . . . . . . Preventing or minimising gas access, or using protective gases or vacuum during welding (formed by material interposed between workpieces B23K 20/18)
20/16 . . . . . . with interposition of special material to facilitate connection of the parts, e.g. material for absorbing or producing gas
20/165 . . . . . . [involving an exothermic reaction of the interposed material]
20/18 . . . . . . Zonal welding by interposing weld-preventing substances between zones not to be welded
20/20 . . . . . . Special methods allowing subsequent separation, e.g. of metals of high quality from scrap material
20/22 . . . . . . taking account of the properties of the materials to be welded
20/227 . . . . . . . . . . . . with ferrous layer
20/2275 . . . . . . . . . . . . [the other layer being aluminium]
20/233 . . . . . . . . . . . . without ferrous layer
20/2333 . . . . . . . . . . . . [one layer being aluminium, magnesium or beryllium]
20/2336 . . . . . . . . . . . . [both layers being aluminium]
20/24 . . . . . . Preliminary treatment
20/26 . . . . . . Auxiliary equipment

23/00 Alumino-thermic welding

25/00 Slag welding, i.e. using a heated layer or mass of powder, slag, or the like in contact with the material to be joined (B23K 23/00 takes precedence; submerged-arc welding B23K 9/18)

25/005 . . . [Welding for purposes other than joining, e.g. built-up welding]
Working by laser beam, e.g. welding, cutting or boring

NOTES

1. This subclass covers:
   - laser working for making a weakened layer, with or without removing material;
   - laser shock processing;
   - apparatus for laser surface treatment;
   - laser ablation.

2. This subclass does not cover:
   - laser assisted deposition which is covered by subclass C23C;
   - laser sintering which is covered by group B22F 3/105 for metallic powder, by group B29C 67/04 for plastics, by group C03B 19/06 for glass or by group C04B 35/64 for ceramics;
   - laser assisted chemical etching which is covered by group C23F 1/00.

26/006 . . . [taking account of the properties of the material involved (B23K 26/32, B23K 26/40 take precedence)]

26/009 . . . [using a non-absorbing, e.g. transparent, reflective or refractive, layer on the workpiece (using a mask on the workpiece B23K 26/066)]

26/0093 . . . [combined with mechanical machining or metalworking covered by other subclasses than B23K (combined welding or cutting procedures or apparatus B23K 28/02)]

26/0096 . . . [Portable laser equipment, e.g. hand-held laser apparatus (surgical laser instruments A61B 18/20); Dental Lasers A61C 1/0046; Hand-held laser dental apparatus for curing resins A61C 19/004)]

26/02 . . . Positioning or observing the workpiece, e.g. with respect to the point of impact; Aligning, aiming or focusing the laser beam

26/03 . . . Observing, e.g. monitoring, the workpiece

26/032 . . . [using optical means]

26/034 . . . [Observing the temperature of the workpiece]

26/0342 . . . [Observing magnetic fields related to the workpiece]

26/0344 . . . [Observing the speed of the workpiece]

26/035 . . . [Observing the speed of the workpiece]

26/035 . . . Aligning the laser beam (automatically B23K 26/042)

26/037 . . . [by pressing on the workpiece, e.g. pressing roller foot]

26/04 . . . Automatically aligning, aiming or focusing the laser beam, e.g. using the back-scattered light

26/042 . . . Automatically aligning the laser beam

26/043 . . . [along the beam path, i.e. alignment of laser beam axis relative to laser beams apparatus]

26/044 . . . Seam tracking

26/046 . . . [by controlling the distance between laser head and workpiece]

26/048 . . . [by controlling the distance between laser head and workpiece]

26/06 . . . Shaping the laser beam, e.g. by masks or multifocusing

26/0604 . . . [by a combination of beams]

26/0608 . . . [in the same heat affected zone [HAZ] (B23K 26/0613, B23K 26/0619 take precedence)]

26/0613 . . . [having a common axis (B23K 26/0619 takes precedence)]

26/0617 . . . . . . . . . . . . . [and with spots spaced along the common axis]

26/0619 . . . . . . . . . . . . . [with spots located on opposed surfaces of the workpiece]

26/062 . . . by direct control of the laser beam

26/0622 . . . by shaping pulses

26/0624 . . . . . . . . . . . . . [using ultrashort pulses, i.e. pulses of 1ns or less]

26/0626 . . . . . . . . . . . . . [Energy control of the laser beam (B23K 26/0622 takes precedence)]

26/064 . . . by means of optical elements, e.g. lenses, mirrors or prisms

26/0643 . . . . . . . . . . . . . [comprising mirrors]

26/0648 . . . . . . . . . . . . . [comprising lenses]

26/0652 . . . . . . . . . . . . . [comprising prisms]

26/066 . . . by using masks

26/0661 . . . . . . . . . . . . . [disposed on the workpiece]

26/0665 . . . . . . . . . . . . . [by beam condensation on the workpiece, e.g. for focusing]

26/067 . . . Dividing the beam into multiple beams, e.g. multifocusing

26/0673 . . . . . . . . . . . . . [into independently operating sub-beams, e.g. beam multiplexing to provide laser beams for several stations]

26/0676 . . . . . . . . . . . . . [into independently operating sub-beams, e.g. an array of spots with fixed spatial relationship or for performing simultaneously identical operations]

26/073 . . . Shaping the laser spot

26/0732 . . . . . . . . . . . . . [into a rectangular shape]

26/0734 . . . . . . . . . . . . . [into an annular shape]

26/0736 . . . . . . . . . . . . . [into an oval shape, e.g. elliptic shape]

26/0738 . . . . . . . . . . . . . [into a linear shape]

26/08 . . . Devices involving relative movement between laser beam and workpiece

26/082 . . . . . . . . . . . . . [Scanning systems, i.e. devices involving movement of the laser beam relative to the laser head]

26/0821 . . . . . . . . . . . . . [using multifaceted mirrors, e.g. polygonal mirror]

26/0823 . . . . . . . . . . . . . [Devices involving rotation of the workpiece]

26/083 . . . . . . . . . . . . . [Devices involving movement of the workpiece in at least one axial direction]

26/0838 . . . . . . . . . . . . . [by using an endless conveyor belt]

26/0846 . . . . . . . . . . . . . [for moving elongated workpieces longitudinally, e.g. wire or strip material]

26/0853 . . . . . . . . . . . . . [Devices involving movement of the workpiece in at least in two axial directions, e.g. in a plane]

26/0861 . . . . . . . . . . . . . [in at least in three axial directions]

26/0869 . . . . . . . . . . . . . [Devices involving movement of the laser head in at least one axial direction]

26/0876 . . . . . . . . . . . . . [in at least two axial directions]

26/0884 . . . . . . . . . . . . . [in at least in three axial directions, e.g. manipulators, robots]

26/0892 . . . . . . . . . . . . . [Controlling the laser beam travel length]

26/10 . . . . . . . . . . . . . [using a fixed support, i.e. involving moving the laser beam]

26/103 . . . . . . . . . . . . . [the laser beam rotating around the fixed workpiece (B23K 26/28 takes precedence)]

26/106 . . . . . . . . . . . . . [inside the workpiece]

26/12 . . . . . . . . . . . . . [in a special atmosphere, e.g. in an enclosure]

26/122 . . . . . . . . . . . . . [in a liquid, e.g. underwater]
Other welding or cutting: Working by laser beam

B23K

26/1224 . . . [in vacuum]
26/1223 . . . [in an atmosphere of particular gases]
26/1225 . . . [of mixed gases]
26/1226 . . . [in an atmosphere of gases chemically reacting with the workpiece]
26/1227 . . . [in an enclosure]
26/1228 . . . [Laser beam path enclosures]
26/12 . . . using a fluid stream, e.g. a jet of gas, in conjunction with the laser beam; Nozzles therefor (B23K 26/12 takes precedence)
26/122 . . . for the removal of by-products
26/1223 . . . [the flow carrying an electric current]
26/1243 . . . [involving specially adapted flow control means]
26/1246 . . . [flow control rate]
26/1248 . . . [flow control direction]
26/124 . . . the fluid stream containing particles, e.g. powder
26/126 . . . the fluid stream containing a liquid
26/1262 . . . [Nozzles; Features related to nozzles]
26/1264 . . . [Supply to, or discharge from, nozzles of media, e.g. gas, powder, wire]
26/1247 . . . [Features outside the nozzle for feeding the fluid stream towards the workpiece]
26/12476 . . . [Features inside the nozzle for feeding the fluid stream through the nozzle]
26/12482 . . . [Detachable nozzles, e.g. exchangeable or provided with breakaway lines]
26/12488 . . . [Means for protecting nozzles, e.g. the tip surface (by breakaway lines B23K 26/1482)]
26/12494 . . . [Maintenance of nozzles]
26/16 . . . Removal of by-products, e.g. particles or vapours produced during treatment of a workpiece (by a fluid stream B23K 26/142)
26/18 . . . using absorbing layers on the workpiece, e.g. for marking or protecting purposes
26/19 . . . Bonding (soldering by means of radiant energy B23K 1/005; joining of preformed plastics parts by heating using laser beam B29C 65/16)
26/206 . . . [Laser sealing]
26/21 . . . by welding
26/211 . . . with interposition of special material to facilitate connection of the parts
26/22 . . . Spot welding
26/24 . . . Seam welding
26/242 . . . Fillet welding, i.e. involving a weld of substantially triangular cross section joining two parts
26/244 . . . Overlap seam welding
26/26 . . . of rectilinear seams
26/262 . . . of longitudinal seams of tubes
26/28 . . . of curved planar seams
26/282 . . . of tube sections
26/30 . . . of three-dimensional seams
26/302 . . . of helicoidal seams
26/32 . . . taking account of the properties of the material involved
26/322 . . . involving coated metal parts (using absorbing layers on the workpiece B23K 26/18)
26/323 . . . involving parts made of dissimilar metallic material
26/324 . . . involving non-metallic parts
26/34 . . . Laser welding for purposes other than joining
26/342 . . . Build-up welding
26/346 . . . in combination with welding or cutting covered by groups B23K 5/00, B23K 25/00, e.g. in combination with resistance welding
26/348 . . . in combination with arc heating, e.g. TIG [tungsten inert gas], MIG [metal inert gas] or plasma welding (laser beam for starting a welding or cutting arc B23K 9/067)
26/351 . . . for trimming or tuning of electrical components
26/352 . . . for surface treatment
26/354 . . . by melting
26/355 . . . [Texturing]
26/356 . . . by shock processing
26/3568 . . . [Modifying rugosity]
26/3576 . . . [Diminishing rugosity, e.g. grinding; Polishing; Smoothing]
26/3584 . . . [Increasing rugosity, e.g. roughening]
26/359 . . . by providing a line or line pattern, e.g. a dotted break initiation line
26/36 . . . Removing material (B23K 26/55, B23K 26/57 take precedence)
26/361 . . . for deburring or mechanical trimming (B23K 26/351 takes precedence)
26/362 . . . Laser etching
26/364 . . . for making a groove or trench, e.g. for scribing a break initiation groove
26/38 . . . by boring or cutting
26/382 . . . by boring
26/384 . . . of specially shaped holes
26/386 . . . of blind holes
26/388 . . . [Trenpanning, i.e. boring by moving the beam spot about an axis]
26/389 . . . [of fluid openings, e.g. nozzles, jets (laser machining of inkjet nozzles B41J 2/1634)]
26/40 . . . taking account of the properties of the material involved
26/402 . . . involving non-metallic material, e.g. isolators
26/50 . . . Working by transmitting the laser beam through or within the workpiece
26/53 . . . for modifying or reforming the material inside the workpiece, e.g. for producing break initiation cracks
26/55 . . . for creating voids inside the workpiece, e.g. for forming flow passages or flow patterns
26/57 . . . the laser beam entering a face of the workpiece from which it is transmitted through the workpiece material to work on a different workpiece face, e.g. for effecting removal, fusion splicing, modifying or reforming
26/60 . . . Preliminary treatment
26/70 . . . Auxiliary operations or equipment
26/702 . . . [Auxiliary equipment]
26/703 . . . [Cooling arrangements (by using a fluid stream B23K 26/14)]
26/704 . . . [Beam dispersers, e.g. beam wells]
26/705 . . . [Beam measuring device]
26/706 . . . [Protective screens]
26/707 . . . [for monitoring laser beam transmission optics]
28/00 . . . Welding or cutting not covered by any of the preceding groups, e.g. electrolytic welding
28/003 . . . [Welding in a furnace]
Other welding or cutting: Working by laser beam

31/00 Processes relevant to this subclass, specially adapted for particular articles or purposes, but not covered by only one of the preceding main groups (making tubes or profiled bars involving operations other than soldering or welding B21C 37/04, B21C 37/08)

31/003 [relating to controlling of welding distortion]
31/006 [relating to using of neural networks]
31/02 [relating to soldering or welding (dip or wave soldering in the manufacture of printed circuits H05K 3/34)]
31/022 . . . (Making profiled bars with soldered or welded seams)
31/025 . . . (Connecting cutting edges or the like to tools; Attaching reinforcements to workpieces, e.g. wear-resisting zones to tableware)
31/027 . . . (Making tubes with soldering or welding)
31/10 . . . relating to cutting or desurfacing
31/12 . . . relating to investigating the properties, e.g. the weldability, of materials
31/125 . . . (Weld quality monitoring)

33/00 Specially-profiled edge portions of workpieces for making soldering or welding connections; Filling the seams formed thereby ([B23K 11/14 takes precedence])

33/002 . . . (Crimping or bending the workpieces at the joining area)
33/004 . . . (Filling of continuous seams)
33/006 . . . [for cylindrical workpieces]
33/008 . . . [for automotive applications]

35/00 Rods, electrodes, materials, or media, for use in soldering, welding, or cutting

35/001 . . . [Interlayers, transition pieces for metallurgical bonding of workpieces]
35/002 . . . [at least one of the workpieces being of light metal]
35/004 . . . [at least one of the workpieces being of a metal of the iron group]
35/005 . . . [at least one of the workpieces being of a refractory metal]
35/007 . . . [at least one of the workpieces being of copper or another noble metal]

2035/008 . . . [at least one of the workpieces being of silicium]
35/02 . . . [characterised by mechanical features, e.g. shape]
35/0205 . . . [Non-consumable electrodes; C-electrodes]
35/0211 . . . [for use in cutting ([B23K 35/0205 takes precedence])]
35/0216 . . . [Rods, electrodes, wires]
35/0222 . . . [for use in soldering, brazing ([B23K 35/0205 takes precedence])]
35/0227 . . . [Rods, wires ([B23K 35/0244 takes precedence])]
35/0233 . . . [Sheets, foils ([B23K 35/0244 takes precedence])]
35/0238 . . . [layered]
35/0244 . . . [Powders, particles or spheres; Preforms made therefrom]

35/025 . . . . . . [Pastes, creams, slurries]
35/0255 . . . . . . [for use in welding ([B23K 35/0205 takes precedence])]
35/0261 . . . . . . [Rods, electrodes, wires]
35/0266 . . . . . . [flux-cored]
35/0272 . . . . . . [with more than one layer of coating or sheathing material]
35/0277 . . . . . . [of non-circular cross-section]
35/0283 . . . . . . [multi-cored; multiple]
35/0288 . . . . . . [Welding studs]
35/0294 . . . . . . [Consumable guides]
35/22 . . . characterised by the composition or nature of the material
35/222 . . . . . . [Non-consumable electrodes]
35/224 . . . . . . [Anti-weld compositions; Braze stop-off compositions]
35/226 . . . . . . [Non-corrosive coatings; Primers applied before welding]
35/228 . . . . . . [Selection of materials for cutting]
35/24 . . . . . . [Selection of soldering or welding materials proper ([B23K 35/34 takes precedence])]
35/26 . . . . . . [with the principal constituent melting at less than 400 degrees C]
35/262 . . . . . . [Sn as the principal constituent]
35/264 . . . . . . [Bi as the principal constituent]
35/266 . . . . . . [Cd as the principal constituent]
35/268 . . . . . . [Pb as the principal constituent]
35/28 . . . . . . [with the principal constituent melting at less than 950 degrees C]
35/282 . . . . . . [Zn as the principal constituent]
35/284 . . . . . . [Mg as the principal constituent]
35/286 . . . . . . [Al as the principal constituent]
35/288 . . . . . . [with Sn or Zn]
35/30 . . . . . . [with the principal constituent melting at less than 1550 degrees C]
35/3006 . . . . . . [Ag as the principal constituent]
35/3013 . . . . . . [Au as the principal constituent]
35/302 . . . . . . [Cu as the principal constituent]
35/3026 . . . . . . [Mn as the principal constituent]
35/3033 . . . . . . [Ni as the principal constituent]
35/304 . . . . . . [with Cr as the next major constituent]
35/3046 . . . . . . [Co as the principal constituent]
35/3053 . . . . . . [Fe as the principal constituent]
35/306 . . . . . . [with C as next major constituent, e.g. cast iron]
35/3066 . . . . . . [with Ni as next major constituent]
35/3073 . . . . . . [with Mn as next major constituent]
35/308 . . . . . . [with Cr as next major constituent]
35/3086 . . . . . . [containing Ni or Mn]
35/3093 . . . . . . [with other elements as next major constituents]
35/32 . . . . . . [with the principal constituent melting at more than 1550 degrees C]
35/322 . . . . . . [a Pt-group metal as principal constituent]
35/325 . . . . . . [Ti as the principal constituent]
35/327 . . . . . . [comprising refractory compounds, e.g. carbides]
35/34 . . . . . . [comprising compounds which yield metals when heated]
Other welding or cutting: Working by laser beam

37/00 Auxiliary devices or processes, not specially adapted to a procedure covered by only one of the preceding main groups (eye-shields for welders worn on the operator's body or carried in the hand A61F 9/00; i.e. A61F 9/002): applicable to metalworking machines other than soldering, welding, or flame-cutting machines B23Q: laser protective screens B23K 26/706: protective shields for other welding methods F16P 1/06

37/003 . . . [Cooling means]
37/006 . . . [Safety devices]
37/02 . . . Carriages for supporting the welding or cutting element
37/0205 . . . [guided by hand]
37/0211 . . . [travelling on a guide member, e.g. rail, track]
37/0217 . . . [the guide member being fixed to the workpiece]
37/0223 . . . [the guide member being a part of the workpiece]
37/0229 . . . [the guide member being situated alongside the workpiece]
37/0235 . . . [the guide member forming part of a portal]
37/0241 . . . [Attachments between the welding or cutting element and the carriage]
37/0247 . . . [Driving means]
37/0252 . . . [Steering means]
37/0258 . . . [Electric supply or control circuits therefor]
37/0264 . . . [magnetically attached to the workpiece]
37/027 . . . [for making circular cuts or welds]
37/0276 . . . [for working on or in tubes (B23K 37/0211 takes precedence)]
37/0282 . . . [Carriages forming part of a welding unit]
37/0288 . . . [Carriages forming part of a cutting unit]
37/0294 . . . [Transport carriages or vehicles]
37/04 . . . for holding or positioning work
37/0408 . . . [for planar work]
37/0417 . . . [for spherical work]
37/0426 . . . [Fixtures for other work]
37/0435 . . . [Clamps]
37/0443 . . . [Jigs]
37/0452 . . . [Orientable fixtures (B23K 37/0461 takes precedence)]
37/0461 . . . [Welding tables]
37/047 . . . moving work to adjust its position between soldering, welding or cutting steps (B23K 37/053 takes precedence)
37/053 . . . aligning cylindrical work; Clamping devices therefor
37/0531 . . . [internal pipe alignment clamps]
37/0533 . . . [external pipe alignment clamps]
37/0535 . . . [longitudinal pipe seam alignment clamps]
37/0536 . . . [for maintaining flanges on tubes]
37/0538 . . . [for rotating tubes, e.g. rollers]
37/06 . . . for positioning the molten material, e.g. confining it to a desired area
37/08 . . . for flash removal

2101/00 Articles made by soldering, welding or cutting
2101/001 . . . [Turbines]
2101/002 . . . [Drill-bits]
2101/003 . . . [Pistons]
2101/005 . . . [Camshafts]
2101/006 . . . [Vehicles]
2101/007 . . . [Marks, e.g. trade marks]
2101/008 . . . [Gears]
2101/002 . . . Honeycomb structures
2101/004 . . . Tubular or hollow articles
2101/005 . . . [Hollow panels]
2101/06 . . . [Tubes]
2101/08 . . . [finned or ribbed]
2101/10 . . . [Pipe-lines]
2101/12 . . . [Vessels]
2101/125 . . . [Cans]
2101/14 . . . [Heat exchangers]
2101/16 . . . [Bands or sheets of indefinite length]
2101/18 . . . [Sheet panels]
2101/185 . . . [Tailored blanks]
2101/20 . . . [Tools]
2101/22 . . . [Nets, wire fabrics or the like]
2101/24 . . . [Frameworks]
2101/26 . . . [Railway- or like rails]
Other welding or cutting: Working by laser beam

2101/28 . Beams
2101/30 . Chains, hoops or rings
2101/32 . Wires
2101/34 . Coated articles { e.g. plated or painted; Surface treated articles}
2101/35 . [Surface treated articles]
2101/36 . Electric or electronic devices
2101/38 . Conductors
2101/40 . Semiconductor devices
2101/42 . Printed circuits

2103/00 Materials to be soldered, welded or cut
2103/02 . Iron or ferrous alloys
2103/04 . Steel or steel alloys
2103/05 . [Stainless steel]
2103/06 . Cast-iron alloys
2103/08 . Non-ferrous metals or alloys
2103/10 . Aluminium or alloys thereof
2103/12 . Copper or alloys thereof
2103/14 . Titanium or alloys thereof
2103/15 . [Magnesium or alloys thereof]
2103/16 . Composite materials { e.g. fibre reinforced}
2103/166 . [Multilayered materials]
2103/172 . [wherein at least one of the layers is non-metallic]
2103/18 . Dissimilar materials
2103/20 . Ferrous alloys and aluminium or alloys thereof
2103/22 . Ferrous alloys and copper or alloys thereof
2103/24 . Ferrous alloys and titanium or alloys thereof
2103/26 . [Alloys of Nickel and Cobalt and Chromium]
2103/30 . [Organic material]
2103/32 . [Material from living organisms, e.g. skins]
2103/34 . [Leather]
2103/36 . [Wood or similar materials]
2103/38 . [Fabrics, fibrous materials]
2103/40 . [Paper]
2103/42 . [Plastics (B23K 2103/16 takes precedence)]
2103/50 . [Inorganic material, e.g. metals, not provided for in B23K 2103/02 - B23K 2103/26]
2103/52 . [Ceramics]
2103/54 . [Glass]
2103/56 . [semiconducting (semiconducting devices B23K 2101/40)]